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HOSPITAL TECHNICAL MEMORANDUM

FIRE PRECAUTIONS

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MINISTRY OF HEALTH : LONDON : HER MAJESTY'S STATIONERY OFFICE
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Fire Precautions

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I. Scope

1. This Technical Memorandum, which replaces circular HM(56)36, gives guidance on general fire precautions in hospitals, including:

(i) fire prevention; being measures aimed at reducing the risk of fire;
(ii) provision of fire fighting equipment and its maintenance;
(iii) fire alarm facilities;
(iv) instructions to staff.

2. It does not deal with the design and structural aspects of fire protection which are dealt with in Hospital Design Note No. 2 (see para. 6). Neither does it include advice on methods of fighting fires as this is more suitable for actual demonstration, e.g. by fire brigade officers when giving instructions to hospital staffs.

II. Fire precautions programme

3. The Minister expects hospital authorities to have a carefully prepared programme defining fire prevention, fire fighting and the movement or evacuation of patients in an emergency, at all premises under their control. This necessitates not only the taking of physical precautions to prevent the occurrence and spread of fires and to provide the means for dealing with such outbreaks, but the co-operation of every member of the staff—medical, nursing, administrative, technical and domestic—to ensure an understanding of their part in the arrangements. Co-operation should be encouraged from the highest levels; whilst the more senior staff will need to depute to others particular duties for ensuring the effectiveness of the emergency plan, they should require to be informed from time to time that the arrangements continue satisfactorily and should have brought to their notice any difficulties or deficiencies that may arise.

4. To supervise the day-to-day maintenance of fire precautions and to co-ordinate and direct the action of staff in a fire emergency, a member of the staff at each hospital should be nominated as the fire officer. It is important that this person should have both the competence and the authority to enable him to carry out his duties effectively. One or more deputies should also be nominated to ensure that a responsible member of the staff is available when the fire officer is absent.

III. Consultation with local fire authorities

5. The Fire Services Act, 1947 requires fire authorities to give advice upon request, on fire prevention and means of escape in respect of buildings in their own areas. Hospital authorities are advised to avail themselves fully of this service, particularly on points specifically mentioned in this Memorandum. Requests for advice should be made to the fire authority.

IV. Means of escape

6. Constructional requirements for means of escape and fire protection in new hospitals is dealt with in Hospital Design Note No. 2, Protection against Fire (H.M.S.O.). The Design Note recognises that where a building is divided into a number of fire resisting compartments which communicate with each other only by way of fire-resisting doors fire outbreaks can be contained within the department of origin. This enables the evacuation of patients and staff to be phased, the first phase being the movement of all persons from a compartment in which fire has started to an adjacent compartment. Only if the outbreak cannot be readily brought under control would it be necessary to undertake the second and third phases which may involve vertical escape and perhaps evacuation of a building.

7. In many existing hospital buildings, where the layout and construction does not enable such arrangements to be made, the evacuation of patients will usually involve the use of the staircases and will need to be undertaken at an earlier stage. Dependence cannot be placed on the use of lifts for the evacuation of patients. In these hospitals it is essential that the fire warning system and the organised fire routine will secure the immediate response of all nursing and other staff who can be spared from unaffected parts of the premises.

V. Indication and illumination of escape routes

8. The recognised means of escape from all parts of all premises including any special emergency exits and exits from staff accommodation should be clearly and indelibly indicated. Any doors which are liable to be confused with exit doors should be marked "No Thoroughfare". The direction of opening should be clearly marked on sliding doors. The colouring and style of exit notices should be standardised throughout each building. Corridors, staircases and lobbies forming part of the recognised means of escape should be provided with electric lighting to a recommended average standard of 7 lumens/sq. ft. at floor level.

9. Lighting fittings in exitways should be group controlled and the controls should be so located that they are not readily available to unauthorised persons. Exit notices should be internally or otherwise illuminated to be clearly seen, e.g. under smoke conditions.

10. The provision of emergency electric supplies and emergency lighting is dealt with in Hospital Technical Memorandum No. 11, Emergency Electrical Services (H.M.S.O. 5s. net).

VI. Fire alarms

11. The fire alarm system is the means whereby the whole of the fire routine will be set in motion. If the calling of the fire brigade, the movement of patients from danger and the assistance of other staff are to be secured promptly, there must be no avoidable delay in giving the alarm.

12. The alarm system should be devised to suit the type, size, and extent of the hospital. The usual requirements are:

(i) Alarm raising facilities within easy reach of all persons in every part of the hospital. As a general guide it is considered that no person should have to go more than 100 ft. to raise the alarm.

(ii) Rapid facilities for calling the fire brigade, preferably by means of a direct telephone line to the nearest constantly manned fire brigade watchroom, with automatic and manual calling facilities.

(iii) Alarm signals located to ensure that they will be heard by all persons who are required to take action in the event of fire.

(iv) A central indicator board to enable the location of the call to be quickly and reliably determined.

Additional information on fire alarms is contained in Appendix 2.

VII. Fire fighting requirements—services and equipment

General

13. Fire fighting equipment generally necessary in hospitals includes, firstly, the water supplies and other items which may be required for fire brigade use and as fixed installations and, secondly, such appliances as hose reels and portable fire extinguishers for use by hospital staff in the event of fire.

14. The fire authority should be consulted in each case, and at an early stage where new construction is planned, to assist in determining the quantities of water which should be provided and the positions for hydrants, risers, etc.

15. At existing premises, appropriate steps should be taken to meet any deficiencies.

Water supplies

16. A basic requirement for fire fighting is an adequate supply of water together with such means as will enable effective jets to be brought into use in any part of the premises without delay.

17. For hydrants and dry rising mains the adequacy of the supply is important but not pressure as this can be applied by the fire brigade pumps.

18. With hose reels and sprinkler installations the pressure of the supply is important as these are required to operate without assistance of the fire brigade pumps. Where the supply available from the public mains is not sufficient it will be necessary to provide water storage and, usually, fixed pumps of adequate capacity and pressure. In these instances duplicate pumps should be provided and operated from a maintained electricity supply (see Hospital Technical Memorandum No. 11).

Water mains

19. Mains for fire fighting should be of such diameter and connected to such sources of supply as will enable an adequate supply of water to be available in any part of the premises. In appropriate instances, usually depending on the layout of buildings on the site, the advantages of ring mains should be borne in mind.

20. Mains supplies which are restricted by a meter should have a full flow valve fitted on the main line and the meter fitted on a by-pass so that the full flow can be obtained at the time of a fire by opening the valve. The full flow valve should be conspicuously indicated as such and be marked with the direction of opening. The requirements of the water undertaking should be ascertained in each case.

21. Guidance on the sizes and pressure loss in pipes is contained in Fire Protection Association Booklet No. 36, Fixed Fire Extinguishing Equipment in Buildings.

External hydrants

22. The disposition of external hydrants needs to be planned with due regard to the layout of the premises, to enable a fire in any part to be attacked without having to lay excessively long lines of hose. Where there are tall buildings with dry rising mains, hydrants should be positioned to suit the inlet connections to the risers.

23. Hydrant systems should be generally in accordance with British Standard Code of Practice, C.P.402.101. The hydrants themselves, hydrant boxes, and hydrant plates used for their indication should comply with B.S.750.

Rising mains

24. Rising mains to serve outlets on upper floors are usually necessary in buildings of more than five storeys.

25. In buildings of not more than 200 ft. in height, rising mains may be dry, i.e. consisting of piping with valved outlets at each upper level, the piping not being connected to a water supply but having inlet connections conveniently placed on external walls to enable the fire brigade to charge the riser at the time of need.

26. In buildings more than 200 ft. in height, wet rising mains are necessary. Details of rising mains are given in Appendix 8.

Automatic sprinklers

27. Automatic sprinkler installations using water are most effective for detecting and extinguishing fire, while at the same time initiating the fire warning system.

28. The provision of sprinklers in hospitals may be justified in areas of high risk where fire is liable to develop unobserved or where, within a main building, an outbreak would constitute an unusual danger to the occupants or be particularly difficult to extinguish, e.g. main stores below ground level.

29. With normal spacing each sprinkler head would cover approximately 100 sq. ft. The number of heads which can be connected to each system will depend on the supply. Piping runs should be arranged to avoid frost damage.

30. Only systems approved by the Fire Offices Committee should be installed and the approval conditions appropriate to the system should be complied with. Installations should be generally in accordance with C.P.402.201.

31. Compartments protected by sprinklers should have good fire resisting separation from adjoining non-sprinklered areas (see Hospital Design Note No. 2, Protection against Fire, for recommendations on fire resistance separation between compartments in hospital buildings).

Other fixed fire extinguishing installations

32. Equipment with special fire risks such as oil-cooled transformers and high-voltage switchgear may justify the provision of a fixed, automatic, inert, gas installation, usually carbon dioxide (CO_2). Such installations are most suitable for enclosed volumes where the gas can be most effective in inerting the atmosphere, and being automatic in operation they can be used to initiate the fire warning system.

33. The provision of fixed fire extinguishing equipment for transformer chambers and high-voltage switchgear is dealt with in Hospital Technical Memorandum No. 7, Electrical Services: Supply and Distribution (H.M.S.O., 7s. 6d. net).

Foam inlets

34. These will usually be necessary where oil-fired boilers and indoor oil storage chambers are accommodated below ground level. These take the form of fixed piping extending between the spaces to be protected and an inlet box accessible from the open air; the external termination should be a coupling to which a foam-making branch can be connected. The fire authority should be consulted regarding a suitable installation in each case.

Hose reels

35. Hydraulic hose reels are simple for unskilled persons to operate and are very effective when used in the early stages of a fire. They have the advantage of affording a continuous water jet which can be easily directed in use and shut down after use, so avoiding unnecessary water damage and waste.

36. Hose reels must be connected to an adequate mains water supply, i.e. sufficient in pressure when using the highest reel to deliver 5 gallons per minute through the nozzle to a distance of 20 ft., e.g. about 20 lbs. per sq. in.

37. Excessive lengths of hose reel tubing may be difficult to run out, especially where changes in direction occur around corners or through doorways. In favourable situations, lengths up to 100 ft. may prove satisfactory; elsewhere a maximum of 75 ft. is to be preferred.

38. The distribution of hose reels should be such that no part of the area to be protected is more than 20 ft. from the nozzle of a reel when the hose is fully run out. They should be located where conspicuous and always accessible, e.g. in a corridor.

39. A non-hinged type of hose-reel is usually satisfactory and has the advantage of causing least obstruction.

40. Rubber hose to B.S.3169 having an internal diameter of $\frac{3}{4}$ in. and equipped with a $\frac{3}{16}$ in. nozzle and stopcock is usually preferred. Data on rising mains for hose-reels is given in Appendix 8.

Portable fire extinguishers

41. All parts of the hospital should be provided with an adequate number of portable fire extinguishers which should be additional to fixed installations, such as hose reels. In most parts of the premises extinguishers of the water/gas pressure or soda acid types will be appropriate but special risks will, of course, require the provision of types suitable to those risks.

42. It is not advisable to introduce a needless variety of extinguisher types, and therefore, the endeavour should be to adopt the smallest number of types which will effectively meet the needs of each premises.

43. Appliances should be mounted on brackets or shelves in conspicuous positions where they will be readily accessible for immediate use. A fixing height of 2 ft. above floor level to the bottom of the extinguisher is recommended. Appliances should not be placed behind doors or in positions where they might obstruct exits or be damaged by trolleys.

44. For general fire protection purposes extinguishers should be located near room exits or near or on staircase landings. Where intended for a particular hazard, they should be conveniently located for the place of risk, but not be so close that they may be inaccessible in the event of fire. Where the special risk is in a confined space, it is usually preferable to position the extinguisher outside.

45. In buildings where a particular layout is repeated, e.g. on different floors, the location of fire appliances should be standardised as far as is practicable on each floor.

46. A distribution of one extinguisher of the 2 gal. capacity per 250 sq. yd. of floor area with at least two extinguishers at each floor level is satisfactory for general risks.

47. The uses and maintenance of fire extinguishers is dealt with in Appendix 3. Further information is contained in C.P. 402: Part III.

VIII. Fire prevention

General

48. Although hospitals contain much flammable material they are not, in general, considered to be a high fire-risk, because staff are always on duty and fire incidents are normally discovered without undue delay and prompt action taken.

49. Most fires, provided highly flammable substances are not involved, can be easily extinguished if attacked immediately they start.

50. In patient accommodation areas, for example, no time need be lost if suitable fire extinguishing apparatus is readily available and the staff on duty know how to use it.

51. Certain departments, e.g. main laboratories and pharmacies, main kitchens, laundries, boiler houses, workshops and main stores carry a higher fire risk and it is in such departments that the majority of fires occur which gain a hold. These departments, particularly where they are within the general fire risk area of patient or staff accommodation, require special attention when planning fire precautions and alarm facilities.

Smoking

52. Statistics show that more hospital fires are caused by the careless disposal of matches, cigarettes and tobacco ash than by any other cause.

53. Smoking should be prohibited in stores and other areas where there is combustible storage. No-smoking areas should be conspicuously marked and no-smoking rules should be strictly enforced.

54. Where smoking is permitted there should be plenty of clearly marked ashtrays or bins for the safe disposal of cigarettes, etc.

Highly flammable materials

55. The use of highly flammable materials should be avoided and suitable alternatives substituted where these are available and their use can be justified economically.

Textile materials

56. Ordinary fabrics such as cotton are highly flammable and contribute significantly to the general fire risk of a hospital. Flame resistant processes for these materials are available which are claimed to be

effective for the normal life of materials. Some of these processes are also claimed to have bacteriocidal properties, to be non-toxic, non-irritant and rot and mildew resistant. Fabrics which are made wholly of wool and synthetic fibres such as nylon and polyesters, will not propagate flame. Glass fibres fabrics are non-combustible and may be suitable for some applications where highly flammable type fabrics have been used previously.

57. Guidance on flame resistant processes is given in P.D. 2777, published by the British Standards Institution; durability tests for fabrics of low flammability are described in B.S.3121. Performance requirements of flameproof materials are dealt with in B.S.3120.

58. At present the more successful processes can add significantly to the cost of articles, but it is expected that prices will fall as the demand for these processes increases.

59. There is greater justification for expenditure on flame resistant treatments for items such as bedding and bed coverings for use with certain classes of patients, e.g. psychiatric, mentally sub-normal, geriatric and paediatric.

Highly flammable liquids

60. The use of highly flammable liquids, and materials containing highly flammable solvents, should be restricted to procedures and processes where the use of substitute materials of lower flammability is not practicable. Special safeguards concerning the use of flammable anaesthetics in operating departments are dealt with in the Report of a Working Party on Anaesthetic Explosions, published in 1956 (H.M.S.O.).

61. Only quantities of highly flammable liquids and substances which are required for immediate use should be kept in hospital departments and additional quantities should be kept in a cool ventilated store, preferably one reserved for highly flammable storage (see para. 64).

62. The storage of ether under unfavourable conditions for long periods, e.g. in high ambient temperatures or exposed to light, can result in the formation of ether peroxides to an extent that spontaneous combustion can occur.

Tests for ether peroxide

63. Place 10 c.cs. of ether to be examined in a clean glass vessel and add one c.c. of freshly prepared 10% aqueous solution of potassium iodide. The presence of significant amounts of peroxide will be indicated by a yellow colouration within five minutes, and in this event, the ether should be destroyed (see para. 78).

Storage of highly flammable substances

64. Highly flammable liquids and other highly flammable substances should be stored in a special enclosure reserved for this purpose. Anti-static precautions should be observed.

65. Extremely hazardous material should be stored alone so as not to endanger less hazardous material which, if ignited, would contribute to the fire. The store should be either a separate building or a fire-resisting compartment of a building accessible only from the open air and at a place where, in the event of a fire in the store, the means of escape from nearby buildings will not be prejudiced. Permanent ventilation should be provided to the outside air. Provision should be made to prevent any possibility of an outflow of the contents; this may be achieved by means of a raised brick sill of sufficient height constructed across the doorway. Doors should open outwards. The store should be indicated, "Highly flammable liquids". (See also Design Note No. 2 Protection against Fire.)

66. In general, artificial heating will not be required in the store and engineering services will be confined to electricity for lighting. Socket outlets should not be provided.

67. Lighting should be adequate to eliminate the need for improvised lighting. Fittings should be of a totally enclosed, robust type, e.g. bulk head type. Switches should be installed externally or be of a flameproof type.

68. All electric wiring should be enclosed in a screw-jointed conduit or consist of mineral insulated metal sheathed cable.

69. All shelves and other fixtures should be of non-combustible construction.

General storage

70. Racks, cupboards, and shelves should preferably be non-combustible and should be arranged so as to be easily accessible.

71. Storage should not be piled so high as to be difficult to reach with fire fighting equipment. In general, there should be a clear space of at least 2 ft. between the ceiling and the top of the storage.

72. Highly flammable substances should be stored in special enclosures reserved for this purpose (see para. 64). Where this is not practicable they should be stored in metal bins with close-fitting lids or other similar non-combustible containers.

73. Adequate lighting should be installed between racks to eliminate the need for improvised lighting.

74. Smoking should be prohibited in store rooms used for combustible goods and prominent notices to this effect should be displayed.

Highly flammable adhesives and floor sealers

75. During the laying of rubber or other floor coverings by means of highly flammable adhesives, smoking should be prohibited and all naked lights, fires, flame or spark-producing appliances capable of igniting flammable vapours should be prohibited in the room where such work is carried out and in any adjacent or adjoining rooms. All windows in the room and doors which communicate with the open air should be opened wide. Doors leading to stores containing flammable materials should be closed. The least quantity of adhesive necessary for immediate purposes should be brought into the room or building. These precautions should continue until the floor covering is completed and until evaporation from the adhesive has ceased.

76. Similar precautions are also necessary during the application of flammable floor sealers.

Plastic splinting

77. Precautions are also necessary where there is plastic splinting which involves the use of highly flammable solvents. Electric hair-driers should not be used to dry such materials.

Safe disposal of highly flammable liquids

78. When, because of contamination or for other reasons, it is necessary to dispose of highly flammable liquids, this is probably best done by burning them in a suitable open, shallow, metal container in the open, well away from any building, flammable storage or drains.

79. Incidents have been reported where highly flammable liquids have been emptied down sinks and being followed by hot water, have resulted in vapour issuing from drains or gullies connected to the system, causing an explosion.

Garaging and petrol storage

80. Motor vehicles should be garaged or parked away from the main hospital buildings.

81. The storage of petrol is regulated by the Petroleum (Consolidation) Act, 1928 and although hospitals are exempted from obtaining a licence it is the Minister's wish that arrangements for the storage of petrol should comply with the requirements of the local licensing authority.

82. Guidance on the storage of petrol spirit is given in a booklet (No. 32) issued by the Fire Protection Association.

Medical gases

83. The following basic safety rules should be strictly enforced where medical gases are used and stored.

(i) Handle cylinders with care.

(ii) Always close cylinder valves after use and when the cylinder is empty. Do not use more force than is necessary.

(iii) Do not open valves more than is necessary (the seatings of some regulators may be forced out under pressure if the valve is unscrewed too far).

(iv) Do not use oil or grease of any kind on valves, gauges, regulators or other fittings associated with medical gas cylinders and installations.

(v) Always "snift" a cylinder by opening the valve slightly and clearing the outlet before connecting any attachment.

(vi) Never drape oxygen cylinders with any materials, e.g. clothing or hospital gowns.

(vii) Where filters are fitted to regulators, etc., ensure that they are cleaned regularly and that the filter is replaced.
(*Note:* Sintered metal filters are coming into use, and it is recommended that, where suitable ones are available, they are substituted for other types.)

(viii) Never attempt to alter or modify any components associated with medical gas installations. Defective items should be withdrawn from service immediately and returned to manufacturers for repair, or replacement.

Storage of gas cylinders

84. Cylinders should be stored in a cool, ventilated store-room. Full cylinders should be stored horizontally in racks and used in rotation as received. Empty cylinders should be stored apart from full cylinders. Details of a typical storage rack are given in B.S.1319.

Liquid oxygen storage

85. Vessels should be located in the open, well away from any building, structure or flammable materials of any kind. All sources of ignition should be excluded from the area and conspicuous "No Smoking" notices displayed. A retaining wall of sufficient height to retain the total contents should be provided around the vessel.

Ethylene oxide

86. Ethylene oxide is a highly flammable toxic gas which is used as a fumigant. It is about $1\frac{1}{2}$ times as dense as air and mixtures with air in concentrations between 3% and 80% by volume are flammable. For cold sterilising processes it should be used only with a diluent to reduce considerably the flammability of the mixture. A 15% ethylene oxide 85% CO_2 mixture is frequently used. This mixture is flammable in certain mixtures with air and those concerned with the handling and use of this gas mixture

should be made aware of the flammable and toxic hazards. The following precautions should be taken:

(*a*) Avoid exposure to heat.

(*b*) Ensure that the purging of equipment and venting of sterilised equipment to atmosphere, including the venting of any relief devices, is carried out in a flameproof area.

(*c*) The toxic threshold for ethylene oxide in air is 24 parts per million and precautions should be taken to ensure that this concentration is not exceeded.

Oxygen tents and hyperbaric oxygen chambers

87. Materials which burn are more easily ignited and will burn much faster when the atmosphere is even slightly oxygen enriched. Special precautions, therefore, are necessary in areas where oxygen tents or oxygen-therapy apparatus is liable to be used. Exhaust and pressure release outlets from hyperbaric chambers should be piped direct to the outer air. Mechanical extract ventilation should be provided in areas communicating with hyperbaric oxygen chambers and care should be taken to see that patients' clothing is freed from oxygen after emerging from a chamber, e.g. by flapping coverings. The use of open flame equipment and smoking must be forbidden within 20 ft. of oxygen tents and hyperbaric oxygen chambers and permanent notices displayed to this effect.

88. Adequate installed low temperature type heating should be provided in the area to eliminate the possibility of portable or other improvised heating being used.

89. It will not normally be necessary to take special anti-static precautions in or around oxygen tents unless highly flammable gases or vapours are also used in the area.

X-ray film storage

90. Since 1941 all x-ray film produced in this country has a cellulose acetate base and is classified " non-flam " although it will burn slowly. Prior to this date x-ray film made of cellulose nitrate was available, and this type of film is very highly flammable and is explosive at slightly raised temperatures. The number of nitrate films which it will be necessary to retain will be small.

" Non-Flam." (acetate) film storage

91. The fire risk associated with this type of film is of the same order as that of paper. Steel cabinets are considered to be the most suitable containers for the storage. Naked lights and other igniting agents should not be permitted in the storage area.

92. If film is not to deteriorate in storage the storeroom temperature should not fall below approximately 50°F. and low temperature type heating should be used. Electric heaters should be of an enclosed convector type installed at a high level and controlled by a room thermostat.

Nitrate film storage

93. Nitrate film should be stored in totally enclosed metal containers with tight fitting lids and should be conspicuously marked " Highly Flammable " in red lettering. Stocks exceeding 80 lb. should be stored in a room of fire resisting construction which is reserved exclusively for this purpose and well ventilated direct to the outer air. The stores should preferably be located in the open, well away from other buildings.

94. Heating should be by safe low temperature means. The store should be kept cool as the material can decompose with lengthy storage, particularly in a warm temperature. It should preferably be equipped with an automatic water sprinkler system.

95. The door to the store should be permanently and conspicuously marked " Film Store—No Smoking ".

Combustible industrial gases

96. Special precautions are necessary where acetylene and other combustible gases are used or stored. Combustible gases should be stored in a room of non-combustible construction and free of any flammable contents. They should not be stored in the same room as oxygen or other medical gases. No artificial heating should be provided in the storeroom, and lighting fittings and switch controls, if in the storeroom, should be of a flameproof type complying with B.S.229.

Laboratories

97. Most laboratory fires are attributed to accidents involving the use of highly flammable liquids in the presence of open flame equipment or ignition sources involving hot surfaces. It is important that the use of highly flammable liquids is restricted as far as is practicable and in general only the quantities which are required for immediate use should be kept in the laboratory.

98. Where heating is necessary only safe forms should be used. In many instances open flame heating can be eliminated by using electric or steam heating arrangements. Special fire precautions for laboratories are dealt with in Appendix 5.

Fish fryers

99. Fish fryers and chip ranges constitute one of the main fire risks in hospitals. Overheating of the frying oil is the usual cause, and this results in vaporised oil being ignited by the heating source or, with exceptional overheating, spontaneous ignition.

100. Precautionary measures against these risks are included in Hospital Technical Memorandum No. 3, Fire Precautions: Fish Fryers (H.M.S.O., 1s. net).

Gas heating appliances

101. Where possible, these should be rigidly fixed and mounted on a suitable non-combustible base, e.g. 1½ in. stone or ¾ in. asbestos. Where practicable, rigid metal piping and screw-type connections should be used. Where it is essential to use a flexible connection it should be of a heavy duty armoured type with metal connections complying with B.S.669.

102. Gas burners, unless fully enclosed in an appliance, should be mounted at least 2 ft. 6 in. above floor level and protected, e.g. by a projecting shelf, to reduce the possibility of clothing being ignited.

103. Gas fires should be rigidly fixed on to a suitable non-combustible hearth or wall and guarded to comply with B.S.1945.

Disposable goods

104. The increasing use of disposable items, many of paper, can significantly increase the fire risk unless appropriate precautionary measures are taken. Attention is drawn to the following:

(i) Flame retardant processes are available for paper and similar materials and treated materials should be used where economically practicable.

(ii) The storage of paper and other flammable items in hospital departments should be restricted to amounts which are required for current use and should be kept in cabinets or containers of non-combustible construction. Additional quantities should be stored in rooms which are constructed and equipped for combustible storage (see para. 64).

(iii) Paper refuse sacks should be mounted on a fixture fitted with a self-closing lid and installed in suitable non-combustible surroundings. Where located in a patient or staff accommodation area, or in corridors or other parts of the hospital forming a recognised means of escape, refuse sacks should be completely housed in a non-combustible container or fire resisting enclosure, e.g. a metal bin with hinged access for removal purposes.

(iv) A conspicuous notice should be provided warning against putting lighted cigarettes or matches in the containers.

(v) Arrangements should be made for full sacks to be disposed of without delay (see para. 105-6).

Combustible waste

105. With the increasing use of combustible disposable items, it is important that there is an efficient routine for the collection and disposal of combustible waste including packing cases, packing materials and workshop waste. It is preferable that such waste is burnt in an incinerator or disposed of in a pulverising unit.

106. It is usually convenient to dispose of waste collected over a 24-hour period during the normal working day. This will entail the provision of safe storage of waste awaiting disposal, e.g. metal bins with well fitting lids. The storage area should be separated by suitable fire resisting construction from the incinerating area; both areas should be well clear of hospital buildings.

Incinerators

107. It is important that the capacity of incinerators is adequate to deal with the amount of waste in order to reduce the risk of overloading. Larger types of incinerators, i.e. having capacities exceeding ⅛ ton per hour, should incorporate facilities for cooling flue gases and preventing hot ash being exhausted to atmosphere from the flue.

108. The charging and working of larger incinerators should be entrusted only to competent operators who have received proper instruction on their correct operation. The incinerators should comply with B.S.3316. (This British Standard also gives advice on the selection and use of incinerators.)

Physiotherapy wax baths

109. Fire incidents have been attributed to overheating of wax baths which have been left switched on overnight in order to eliminate a heating up period during working hours. The fire risk (and electricity consumption) can be reduced by using a time-switch to control the socket outlets used with wax baths.

110. Because of the highly flammable nature of the wax special attention should be given to thermal safety devices on these appliances. In addition to a reliable thermostat to control the temperature a manually resetting type thermal cut-out should be provided which should be pre-set to avoid dangerous over-heating.

111. The heat sterilising of physiotherapy wax can constitute a serious fire risk unless carried out in suitable non-combustible surroundings and properly supervised. Suitable fire extinguishing apparatus should be at hand, e.g. a 2 gallon foam type or 10 lb. powder type extinguisher.

Roof spaces

112. These should be kept clear of combustible storage and should be inspected periodically.

Engineering controls

113. Controls of engineering installations, i.e. gas, water and electricity, should be clearly indicated as to the parts of premises supplied, etc., and should be readily accessible at all times.

Electric wiring

114. Temporary and improvised wiring is potentially dangerous and permanent wiring having good

fire protecting properties, e.g. M.I.M.S. cables or wiring enclosed in screw-jointed conduit should be provided where practicable and installed in accordance with the I.E.E. Regulations. Where it is necessary to use temporary wiring, only cables having a protecting sheath in addition to the functional insulations should be used, e.g. P.V.C. sheathed cables complying with B.S.2004. In general, permanent wiring should be used for installations which will be required for more than 3 months.

Switch and fuse-gear

115. This should be housed in non-combustible enclosures and should be installed so as to be readily accessible at all times. Each switch should be marked to indicate the circuits controlled.

116. Fuses and circuit breaker settings should be correctly rated to suit the loading and labelled. It is dangerous to over-fuse circuits.

Switchrooms

117. Switchrooms should be free from storage of items other than fuses and other components which may be required in an emergency. Fire precautions for H.V. and M.V. switchrooms are included in Hospital Technical Memorandum No. 7.

Transformer chambers

118. Fire precautions for transformer chambers are included in Hospital Technical Memorandum No. 7.

Electric heaters

119. The provision of adequate safe heating will eliminate the use of improvised unsafe heating. Electric space heaters should preferably be of a low temperature (convector) type. Where radiant type heaters are used they should be installed at a high level or on a properly constructed hearth of adequate dimensions and well clear of curtains and other flammable draping. Heaters should be guarded to comply with B.S.1945.

120. The use of portable space heaters is not recommended.

Note: Electric heaters having totally enclosed heating elements can build up dangerous temperatures if the heat dissipating surfaces are covered or draped. Guards should be provided as necessary to prevent this.

121. Neon type indicating lamps arranged to show when the current is switched " on " should be provided with outlets that are used regularly with non-luminous type heaters, e.g. sterilisers, incubators, electric irons, heating pads, drying ovens and film processing units.

122. Where electrically heated appliances such as film processing units, incubators and drying ovens are liable to be kept switched on whilst premises are unoccupied a pre-set thermal cut-out should be provided in addition to the control thermostat.

Electric irons

123. Proper arrangements should be made, where electric irons are likely to be used, to reduce the fire risk, including the provision of non-combustible iron-stands. The provision of adequate official facilities will reduce the unauthorised use of electric irons in staff bedrooms, etc.

124. The fire risk is usually less with thermostatically controlled irons. Where electric irons are regularly used consideration should be given to the use of cordless type irons with permanently installed, thermostatically controlled heating units. These are considered to be safer than electric irons having a cord connection to the supply.

Electric heating pads and blankets

125. Investigations into incidents involving the use of electric heating pads and blankets have shown that moisture constitutes the greatest risk with these appliances. Accurate and reliable temperature control is also important. Manual controls for varying the degree of heating introduce the possibility of misadjustment and should be eliminated where possible.

126. Electric heating pads for hospital use are dealt with in B.S.3857. This covers a single heat pad having good waterproof protection and accurate temperature control. It is planned to produce a standard for a hospital type electric blanket in due course. In the meantime it is recommended that electric blankets used in hospitals should incorporate the safety measures of B.S.3857 as far as they are applicable, particularly those dealing with waterproofing and thermal safety.

Battery rooms

127. Naked flames should not be brought near batteries whilst they are being charged. Battery rooms should have adequate permanent ventilation direct to the outer air and a prominent " No Smoking " notice should be displayed.

Emergency lighting and emergency electric supplies

128. Improvised arrangements made during power failures can increase the fire risk. The provision of emergency electric supplies is dealt with in Hospital Technical Memorandum No. 11. In parts of hospitals not equipped with installed emergency lighting, portable battery-operated lanterns should be provided.

Lighting fittings

129. These fittings should be constructed of non-combustible materials and be installed well clear of flammable materials. Under no circumstances should lamps of a higher wattage than that for which fittings are designed be used. Wiring within lighting fittings which is liable to be subjected to high temperatures should be of a heat resisting type, e.g. complying wth B.S.3249, 3258, or 3387.

Special risks in anaesthetising areas

130. Precautionary measures for electrical installations and equipment which may be used in the presence of flammable anaesthetic gases and vapours are included in "A Report of a Working Party on Anaesthetic Explosions" (H.M.S.O., 2s. 6d. net).

Servicing of electrical installations

131. Regular testing and servicing of electrical installations is an essential fire precaution and should include electrical resistance and earth continuity tests as prescribed in the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers. Recommended maintenance procedures for electrical installations and equipment are included in Hospital Technical Memorandum No. 13, Planned Preventive Maintenance: A System for Engineering Plant and Services (H.M.S.O., 6s. net).

Lightning conductors

132. Main hospital buildings, particularly those used for patient accommodation, should be protected against lightning (see British Standard Code of Practice C.P. 326.101).

133. Lightning conductor systems should be examined annually for signs of corrosion and other damage and the resistance to earth tested. Probably the best instrument for this test is an earth-fault-loop impedance tester having a continuity testing lead. With this instrument it will be necessary to make the test at a point convenient to a mains socket outlet, but the test point should be as remote from the earth point as possible. In most instances it will be necessary to extend the continuity test lead and an allowance should be made for the resistance of the lead where this is significant. An earth resistance less than 1 ohm is desirable. In no case should the resistance exceed 10 ohms. Suggestions for lowering earth resistance are included in C.P. 326.101. Lightning protection will be dealt with in greater detail in a separate Technical Memorandum.

Staff rooms

134. Where staff rooms are used for changing or as cloakrooms, proper provision should be made for clothing, e.g. metal lockers. Fires are frequently attributed to the unauthorised use of electric heaters, boiling rings and electric irons in staff rooms. The provision of adequate safe facilities together with the strict enforcement of rules forbidding the use of privately owned equipment except in locations specially set aside for their use, are important factors in eliminating this type of risk.

135. Other precautions are:

Prohibition of unauthorised extensions to electrical installations and excessive use of flexible wiring extensions.

Mirrors should not be fixed immediately above heaters.

Electric irons, see paras. 123-124.

Electric heaters, see para. 119.

Airing linen

136. Proper safe facilities for airing linen should be provided in staff quarters, nurseries, etc., to eliminate the need for improvised methods.

137. Materials should not be draped over electric heaters, including those of a low temperature type, e.g. convector or night store heaters, as dangerous temperatures can build up when the heat dissipating surfaces of such appliances are covered. Suitable warning notices should be provided where such appliances are installed at a low level.

Ventilation systems

138. Ventilation systems should not be common to both patient areas and hazardous situations. Advice on the ventilation of various areas is included in Design Note No. 2.

139. Fresh air intakes should be sited to avoid the possibility of the intake of smoke or sparks from nearby flues.

140. Electric wiring having combustible insulation, and electric motors, should not be located in intake or delivery ducts.

141. Disused ventilation shafts and ducts can carry smoke, fumes., etc., and assist the spread of fire. If they cannot be dismantled, they should be effectively sealed.

Laundries

142. The ignition of fluff which collects in drying rooms under drying machines and in drying tumblers and other laundry machines can result in the rapid spread of fire. It should be prevented from accumulating and, in addition to regular removal from the more accessible places, electric motors and heating coils, ducts of drying rooms and tumblers should be regularly cleaned. The fibres comprising such fluff may be ignited by the steam heated surfaces of the drying room or may be ignited spontaneously where soap fat from dripping blankets is present. There is also a danger of spontaneous combustion of laundry work which, having been dried in a drying tumbler, is allowed to remain in the machines or is unloaded without folding, into a trolley. Such work should not be allowed to remain in a concentrated heap from which heat cannot quickly dissipate. If time does not allow the articles to be folded in the normal manner they should be removed from the machine on to a trolley and spread out in such a way that their heat is quickly lost.

IX. Staff instruction

143. It is of little use providing the protection of separate fire compartments, alternative means of escape and other fire precautions if, at the time of an emergency, these arrangements are not fully understood by all concerned; for continuous fire safety regular training of hospital personnel is absolutely essential.

144. Since only a proportion of the staff on duty can be made available for instruction at any one time, and having regard to constant changes of staff, instruction needs to be given at sufficiently frequent intervals to ensure that all personnel are familiar with the action which they should take on discovering a fire and on hearing the fire alarm signal. To this end, a responsible officer should be nominated for arranging for instruction to be given to staff, and he should receive the support and co-operation of all departments in the carrying out of his duties.

145. By arrangement with the fire authority, the services of the fire brigade should be utilized where possible in giving instruction to staff and, in particular, for instructing on the use of fire extinguishing equipment.

146. At least twice a year practice fire drills should be carried out simulating conditions in which one or more of the escape routes is obstructed by smoke. During these drills the fire alarm should be operated by a member of the staff who is told of the supposed outbreak and, thereafter, the fire routine should be rehearsed as fully as circumstances allow.

147. The principles of fire and evacuation procedures should also be taught at Nurses' Training Schools but must afterwards be related to the arrangements actually in force at each hospital.

Raising alarm

148. All staff should be given details of how to operate the fire alarm system and know the locations of manual fire alarms points, internal fire telephones, fire alarm indicator panels, and the correct method of calling the fire brigade.

Telephone operators

149. The exact procedure to be followed by telephone operators will, of course, depend on the fire warning and alarm system installed in the hospital, but it is important that all operators, including any relief operators, should receive precise instructions on the action to be taken and, in particular, the action they should take on being notified of a fire by telephone or any other means. In hospitals where the switchboard is not continuously manned it will be essential to ensure that the calling of the fire brigade is the first responsibility of a competent person who, together with deputies, has been nominated for this duty.

Engineering staff

150. Members of the engineering staff should receive instructions on the location and use of the main controls for the electrical, oil, water and gas installations, including those of any medical gases, and should be familiar with the distribution of these installations.

Fire brigade guide

151. Upon any warning of fire the Hospital Fire Officer should immediately delegate one member of the staff to meet the fire brigade at the entrance to the premises and to direct them to the fire.

Fire doors

152. All staff, nursing staff in particular, should be made aware of the location of the fire doors and their importance in preventing the spread of fire. Where it is necessary for any doors to be held open during busy working periods, means should be provided of a type which can be readily released by a nominal pull on the door; temporary expedients, such as wedges or weights, should not be permitted. For further information on fire-resisting doors see Design Note No. 2.

Fire lifts

153. In buildings more than five storeys high there should be at least one fire lift arranged so as to be available for the exclusive use of firemen in an emergency and, for this purpose, provided at ground level with a special fire switch the operation of which overrides all other controls and returns the lift to the ground floor.

154. Instructions to staff should normally assume that lifts will not be used for evacuating patients.

Fire instructions notices

155. At conspicuous positions in all parts of hospital buildings printed notices should be exhibited stating in concise terms the main essential of the action to be taken upon discovering a fire and on hearing the alarm. In addition, notices giving more detailed instructions should be exhibited in all staff rooms, in staff residential accommodation, and on notice boards. Examples of typical notices are given in Appendix 1.

Appendix 1

Fire instruction notices

The following is an example of a staff fire instruction notice for display in all staff rooms, staff residential accommodation and on notice boards.

FIRE INSTRUCTIONS

.....(Name of Hospital.)

1. **Detection of fires**

Anyone detecting smoke or a smell of burning should investigate immediately and raise the alarm if a fire is suspected.

2. **Raising alarm**

(*a*) ***Internal telephone*** Dial (insert appropriate emergency code no., e.g. 666).
*Give operator the exact location of fire.
*Wait until zone alarms sound and then replace receiver.

(*b*) ***Public telephone*** Dial 999, ask for fire service. Inform fire brigade:
Fire at.....Hospital
.....(address).

(*c*) ***Fire alarm*** Break glass.

3. **Calling the fire brigade**

On any outbreak of fire, however small, ...(responsible person) will immediately call the fire brigade in accordance with instructions displayed at.....
(location from which fire brigade is to be called).

4. **Extinguishers**

Take extinguishers to the scene of the fire, then —NOT BEFORE—operate and direct jet into the *seat* of the fire.

5. **Doors**

Shut all doors and windows in the room or area in which the fire is discovered.

6. **On hearing the *(first stage) alarm**

Nursing staff on duty in wards

(i) Where necessary, remove patients from immediate danger. Elsewhere, stand by in the wards.
(ii) Close windows.
(iii) Prepare for the evacuation of patients but await instructions from the senior person in charge.

STAFF HAVING SPECIFIED DUTIES—proceed accordingly.

7. ***On hearing the second stage alarm**

All available staff not having specific fire duties—Proceed to the fire assembly point at.....
.....(location) and act as instructed by the senior person present.

8. **Duty of staff**

(i) To study this Notice, to know what to do in the event of fire and to know how to use the fire appliances.

(ii) To make certain that you are familiar with all the means of escape in case of fire and to ensure that staircases, landings and other escape routes are kept clear from obstruction at all times.

(iii) To prevent any possible causes of fire.

In addition to the more detailed staff instructions, brief, clearly printed, general fire notices should be exhibited in conspicuous positions in all parts of the hospital. The following is an example:

1. On detecting a fire, raise alarm immediately by (as 2 above).
2. On hearing the fire alarm, proceed immediately to.....

*As appropriate.

Appendix 2

Fire alarm systems

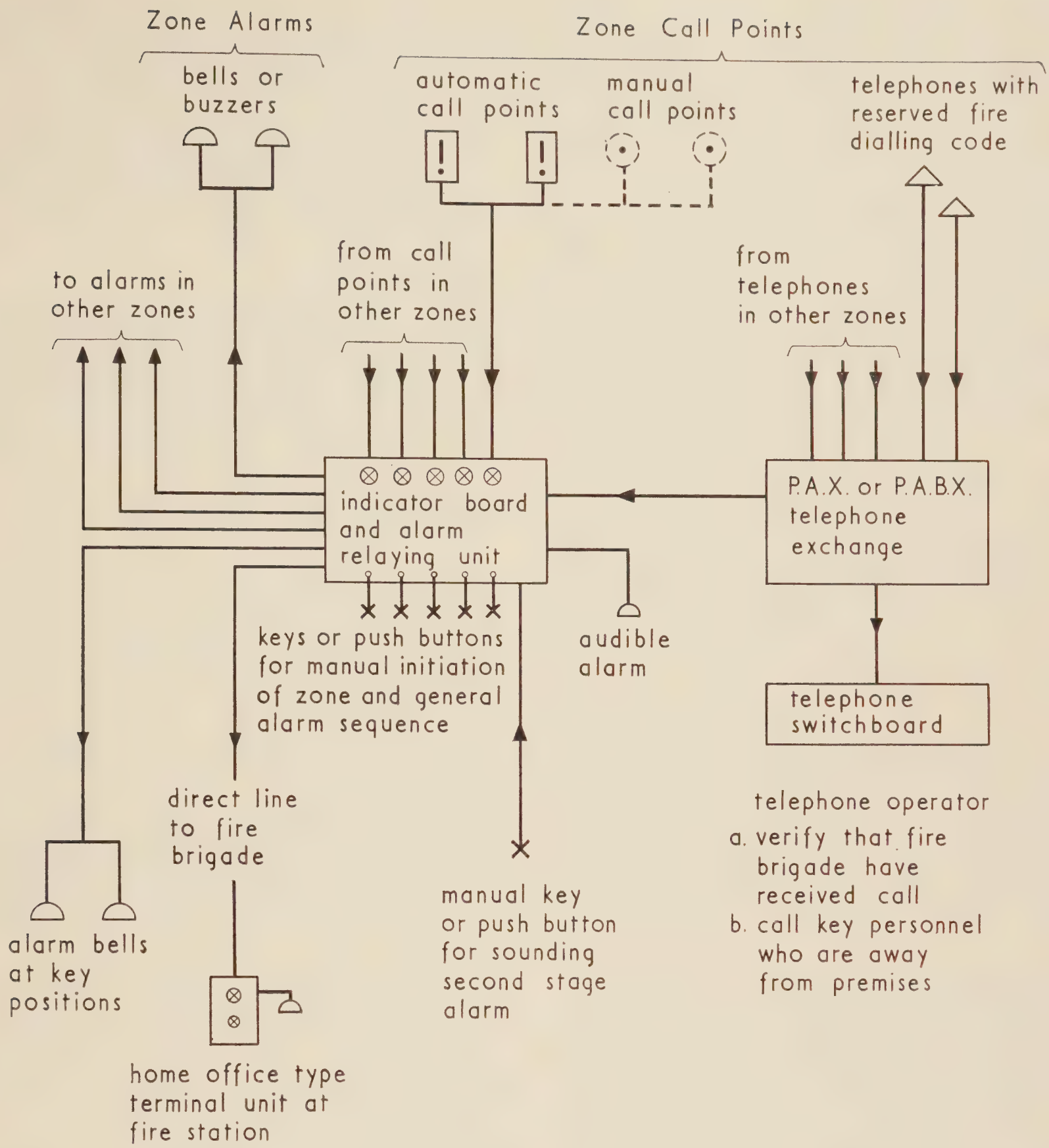
General

1. The most suitable fire alarm system may differ for different types of hospitals and also in different parts of a hospital. This is a complicated subject which calls for specialist advice.

2. Manually operated arrangements for raising the alarm are only suitable for those parts of a hospital where persons are always on duty, e.g. ward areas. For other parts of a hospital which may be unoccupied for significant periods, e.g. outside normal working hours, and which contain equipment or installations that constitute a significant fire risk, an automatic fire detector system is desirable, particularly where these areas adjoin wards or other residential parts of the hospital.

3. The arrangement of alarm signals for summoning the assistance of those who are required to take action in the event of fire, will also vary with the size and type of hospital.

4. The alternative arrangements of fire alarm systems are discussed in the following paragraphs. Fig. 1 shows a typical arrangement.



Notes:

(i) In the event of the fire code being dialled on telephone or call points operating, the fire alarm sequence will be automatic.

(ii) It will not normally be necessary to install manual call points in addition to telephones with reserved fire dialling code.

(iii) The indicator board should be located at a central position, preferably in the telephone switchroom or duplicated in the telephone switchroom so that the alarm can be raised manually in the event of the call being passed direct to the operator.

FIG. 1. Typical arrangement of fire alarm system

Manually operated systems

5. In areas which are staffed throughout the 24 hours of every day, outbreaks of fire will be quickly detected and the alarm raised manually. This can be done either by (i) the operation of manual call points of the " break glass " type or (ii) the use of the internal telephone service. As a general guide it is suggested that the location of call points should be such that no person need go more than 100 ft. to raise the alarm.

6. It has been found that where hospitals are equipped with a comprehensive internal telephone system, telephones are more frequently used for raising the alarm than manual call points.

7. The advantage of a special fire alarm system is that circuits can be so arranged that they are constantly monitored to detect faults. This greatly reduces the possibility of undetected faults but reliability is still dependent on frequent routine servicing. Telephone systems are not normally equipped with automatic fault detection, but because of frequent use, faults are likely to be soon discovered.

8. Because of the possibility of misunderstanding, in general it is inadvisable to have more than one manually operated fire alarm system, therefore, " break glass " and automatic telephones should not be embodied in a single installation. There is no objection, however, to manual and automatic call points being incorporated in the same system.

Internal telephone systems

9. Where internal telephones with automatic dialling are provided, the extension instruments can serve as call points for the fire alarm system where the following requirements are met:

(i) A dialling code is reserved solely for use in the event of fire.

(ii) An adequate number of suitably sited telephones is provided throughout the premises. This may necessitate the provision of telephones additional to requirements for normal communication purposes and these telephones should be easily accessible and conspicuously indicated.

(iii) Fire calls should be automatically relayed to the fire brigade or should raise the alarm at a central, constantly manned position from which the fire brigade can be called (see para. 26-30).

(iv) Fire calls should automatically operate the warning signals (see para. 31-36).

(v) The location of the call should be automatically indicated in a central position (see para. 24). Where automatic fire detectors are provided a common annunciator panel should be used.

(vi) The telephone operator should receive audible warning of fire calls. It is also considered desirable for the operator to be able to connect immediately with the caller.

(vii) The telephone operator should have facilities for initiating the fire warning sequence in the event of fire calls being communicated as normal calls.

Manual call points

10. A system of manually operated call points should be provided throughout hospitals where the telephone system is inadequate for this purpose. As far as possible the call points should be conspicuously positioned on frequently used routes and be easily accessible and well illuminated. In ward blocks the most suitable position will usually be adjacent to the exits from each ward unit or on staircase landings.

11. Where in multi-storey blocks the layout of floors is similar on each of several levels, the position of call points also should be repeated. The type of call point adopted should be the same throughout the whole hospital.

Automatic fire detectors/Automatic call points

12. Early warning of an outbreak of fire can be obtained by installing automatic fire detectors. These facilities may be justified in parts of hospitals which are unoccupied for long periods and which contain significant fire risk, e.g. laboratories and pharmacies, workshops, laundries, and rooms containing flammable stores.

13. Partial protection by automatic fire detectors is undesirable and where detectors are installed they should cover the whole area of the compartment which should be separated from unprotected areas by suitable fire resisting construction.

14. Two basic types of fire detectors are employed; one type is heat sensitive and the other responds to the presence of smoke.

Heat sensitive detectors

15. Several different types of heat sensitive detectors are available. Many utilise bi-metallic devices, but others rely on fusible elements, changes of electrical resistance with heat (thermistors), thermocouple action, and the expansion of fluids.

16. Detectors which respond to temperature conditions in a given limited area under the ceiling are known as " point " or " spot " detectors, while those which are arranged to sense temperature conditions over an extended area of ceiling are known as " line " detectors.

17. B.S.3116 is applicable to heat sensitive point detectors and specifies minimum and maximum response times for specific rates of temperature rise.

The minimum period has the purpose of reducing the risk of false alarms due to temperature rise in non-fire conditions, e.g. space heating. All heat sensitive detectors are designed to operate at a specified maximum temperature but in addition some detectors incorporate a separate element which is sensitive to rate of rise of temperature and will therefore operate at temperatures lower than maximum if the rate of rise of temperature is abnormally high.

18. The performance requirements in the British Standard are applicable to premises having a specific maximum* ceiling height. The size of fire necessary to operate a detector increases with the ceiling height and automatic detectors should not be used with ceiling heights in excess of that specified in the British Standard.

19. There is at present no national standard for line detectors.

Smoke detectors

20. There are two types of smoke detectors. One type utilises the effect of smoke particles in an open ionisation chamber and the other relies on the clouding effect of smoke in a photo-electric device. There is at present no nationally accepted standard for smoke detectors.

21. Smoke detectors can be extremely sensitive, possibly more so than heat sensitive detectors. A limit must be placed on their sensitivity, however, to avoid the risk of false alarms from sources other than smoke particles, e.g. fine dust, water droplets, etc. It should be noted that this type of detector is relatively insensible to fires involving alcohols, ethers, etc., which give rise to little smoke when burning.

Fixing heights

22. Detectors should be fixed at intervals close to the ceiling where they will respond to hot gases or smoke. The sensing element of heat sensitive types should be located not less than 1 in. and not more than 4 in. below the ceiling and smoke detectors not less than 1½ in. and not more than 2 ft. below the ceiling.

Approved systems

23. The Fire Offices Committee has rules governing the provision of automatic fire alarms and conditionally approve specific fire alarms systems. The approval conditions include specification of maximum floor area coverage for different types of detectors. Typical values are 400 sq. ft. for heat sensitive detectors and 1,000 sq. ft. for smoke detectors.

Location indication

24. The annunciator panel should be located in a central position on the ground floor where it will be accessible at all times. It is usually preferable to locate the panel or a duplicate in the telephone switchroom.

25. Each circuit should have a separate indicator (e.g. 2 lamps in parallel), the number depending on the size of the hospital and the number of floors to be protected. The number of circuits should be no more than is necessary to enable the location of a fire to be reliably and quickly determined for the purpose of directing the fire-fighting and removal of patients, etc. Generally a separate circuit should be used for each floor level. In larger buildings, e.g. where there are two or more wings, a separate circuit should be used for each floor in each wing. In general, the area covered by each circuit should approximate to the area covered by a main staircase and exit for the purpose of means of escape.

Facilities for calling the fire brigade

26. Effective and reliable means for calling the fire brigade is essential and the local fire brigade Chief Officer should be consulted in deciding the best method for each premises.

27. A direct telephone line to the nearest constantly manned Fire Authority control room is the most reliable method, and should be provided where practicable and acceptable to the fire authority concerned, preferably by extending the alarm system to terminal equipment at a fire station. Where long distances are involved it may be possible for more than one hospital to share a line using multi-channel signalling.

28. Even where fire calls are automatically relayed direct to the fire brigade, manually operated facilities to initiate the fire alarm sequence should be provided in a constantly manned part of the hospital, e.g. the telephone switchroom. Where, for example, in smaller premises, it cannot be arranged for one position to be constantly manned, the calling facilities should be duplicated to ensure complete cover at all times. In these instances change-over switching should not be used because of the possibility of mistakes.

29. Where a direct telephone line cannot be arranged the G.P.O. emergency should be used. In areas where an emergency service is not available the local telephone manager should be consulted on the best method of obtaining priority for emergency calls.

30. Special problems will arise where a hospital has an unmanned satellite telephone exchange working in conjunction with a main exchange at another hospital. In such circumstances one of the following alternative arrangements may be suitable:

(i) A direct line to the fire authority.

(ii) A telephone line to the main exchange which is reserved solely for emergency use.

* At present 15 ft., but it is understood that recommendations for higher ceilings are under consideration.

(iii) A G.P.O. exchange telephone which is independent of the normal telephone system, located at a constantly manned position (or alternative positions—see para. 28) reserved solely for emergency use.

Staff warning signals

31. The staff warning system should be arranged to suit the size, type and extent of the hospital, and be designed to ensure that the warning is perceptible to all persons who are required to take action in the event of a fire.

32. Audible warning signals will usually be required at the following locations:

Telephone switchboard (and any other positions from which the fire brigade may be called)

Matron's office

Nursing stations in ward areas

Staff hostels and residences

Appropriate places in engineering and administrative departments.

33. Loud sounding devices may be avoided in ward areas, e.g. by the use of buzzers and lights, but these should be readily distinguishable from those of the patient/nurse call system.

34. In a small hospital a simple system in which all warning signals are sounded (preferably automatically when the call is made) may be the most suitable arrangement.

35. In larger hospitals and where the premises comprise several buildings it may not always be appropriate for the whole routine to be carried out on every occasion. In particular, it may be desirable to arrange that the movement of nurses from buildings or parts of premises which are not immediately affected by fire can be delayed unless or until it is known that their assistance is required at the place involved. To meet these circumstances a two-stage alarm system may be required in which the preliminary warning sounds as a series of intermittent pulses and the full alarm sounds continuously, both stages being effective over the whole area covered by the installation. At the preliminary stage, all the essential elements of the fire routine—such as the calling of the fire brigade and action by key members of the staff and those in the building or immediate area of the call, must proceed at once, while the staff not immediately required are alerted and, so far as possible, may begin to disengage themselves from their normal duties in anticipation of a full alarm.

36. Many variants of such systems are possible; it is of first importance that the arrangements should be suitable for the particular premises concerned and such as to assist a fully effective fire routine.

Fire alarm circuits

37. Two basic types of circuits are used, viz. " open circuit " in which the call point contacts are normally open and are connected in parallel, and " closed circuit " in which the call point contacts are normally closed and are connected in series.

38. Closed circuits have the advantage that they allow a continuous current to be passed through the wiring and the call point contacts for the purpose of indicating circuit faults. Some closed circuits, however, have normally open call point contacts.

39. Whatever circuit arrangement is used it is recommended that the wiring be continuously monitored and that a warning is given in the event of open circuit or short circuit faults.

40. In order to obtain central indication of the location of a call it will usually be necessary to divide the installation between a number of circuits depending on the size and extent of the hospital, and for each circuit to be wired back to the central indicator board. With a large or widespread hospital this will involve a considerable amount of wiring. Recent circuit developments have the aim of reducing the amount of wiring, but such circuits usually involve the use of additional equipment so that only on larger installations is there likely to be an overall saving.

41. The basic desirable requirements for fire alarm circuits in hospitals are:

(i) Audible warning at a central and other appropriate locations with visual indication of the location of the fire call (see para. 24-25).

(ii) Automatic relaying of the call to the fire brigade (see para. 27).

(iii) Facilities at the central station for passing fire calls to the fire brigade and initiating the alarm procedure.

(iv) Manual operated reset and alarm signal cancellation.

(v) Automatic circuit fault indication with audible warning.

(vi) Automatic supply failure alarm.

(vii) Simple testing facilities for verifying that the system is in proper working order.

Circuit wiring

42. As the main purpose of a fire alarm system is to give early warning of fire, there is no need for fire alarm circuit wiring to have special fire resistance and conventional wiring systems, e.g. wiring enclosed in screwed, solid drawn conduit or steel trunking will be satisfactory.

43. Some systems employ a coaxial type cable having an insulation which has a low resistance to heat. In this way softening of the insulation when

heated can result in a short circuit between the central and outer conductors and so be used to raise the alarm. For such circuits to be effective, a higher than usual operating voltage will be necessary, and it is doubtful if this type of cable would be fully effective at potentials below normal mains voltages.

Segregation of circuits

44. No special segregation of fire alarm circuit wiring from other wiring will normally be justified other than is necessary to comply with No. 214 of the Regulations for the Electrical Equipment of Buildings issued by the Institution of Electrical Engineers. Although fire alarms frequently operate at voltages lower than the mains voltage, mains quality wiring should be used so that the wiring can be enclosed with mains or signal wiring, as is convenient.

Power supplies

45. Fire alarm circuits should be energised from a supply that is maintained in the event of a power failure. The operating voltage should preferably not exceed 100 volts and in no case should it be greater than 250 volts. Facilities should be provided so that any supply failure involving the fire alarm circuits operates the fault alarm device.

46. Where a standby generator maintained supply is available it is not considered necessary to have a secondary battery also to maintain the supply but a small battery supply will be required to operate the supply failure alarm and possibly for other special purposes.

47. Where the fire alarm system is energised from a battery, it should be capable of maintaining the maximum load for one hour. Battery charging facilities should preferably be automatically controlled and be capable of recharging the battery in 8 hours.

Appendix 3

FIRE EXTINGUISHING APPLIANCES AND FIXED INSTALLATIONS

Portable appliances

Type	*British Standard*	*Use*	*Remarks*	*Maintenance*
Water (soda-acid)	B.S.138	General, i.e. paper, wood, textiles. (Not recommended for electric fires.)	Contain solution of sodium bicarbonate in water and a glass bottle containing sulphuric acid. When operated acid is released and reacts with alkaline solution to produce gas which expels the water.	Open annually. Check water level. Check for signs of corrosion and for clear outlet. Check plunger or hammer for free movement. Replace acid bottle if cracked. Recharge every 5 years, except those provided with loose stopper acid bottle, in which case recharge every 2 years.
Water (gas pressure)	B.S.1382	as above	Contain water with anti-freeze and non-corrosive agent. Gas (CO_2 or nitrogen) stored in cartridge which is pierced when operated. Contents less corrosive than soda-acid type and therefore to be preferred.	Open annually. Check water level. Check for signs of corrosion, damage and for clear outlet. Check plunger for free movement. Weigh gas cartridge and renew if weight loss exceeds 10%. Recharge every 5 years.
Water (stored pressure)	B.S.3709	as above	Contain water with anti-freeze and non-corrosive agent and air under pressure. A tell tale or gauge indicates whether or not pressure is satisfactory. Recharging is simple—usually by hand pump. Less corrosive than soda acid type.	Open annually checking pressure indicator, both before discharge and after recharge (discharge extinguisher before opening). Check that operating mechanism is in good order. Check for signs of corrosion, damage and for clear outlet.
Chemical foam	B.S.740 Part 1	Flammable liquids	Contain solution of sodium bicarbonate and solution of aluminium sulphate in water. The two solutions mix when operated producing foam and actuating gas.	Open annually. Check liquid levels of outer and inner containers. Check for corrosion, damage, and that plunger moves freely. Recharge every 2 years.
Mechanical foam (gas pressure)	B.S.740 Part 2	as above	These are similar to chemical type except that foam is expelled by a gas (CO_2) stored in a cartridge which is pierced when extinguisher operated.	Open annually. Weigh cartridge, renew if weight loss exceeds 10%. Check for corrosion, damage and that plunger moves freely. Recharge every 2 years.
Dry powder (gas cartridge)	B.S.3465	Flammable liquids and electrical fires	Contain powder (usually sodium bicarbonate with additives) which is expelled by gas (CO_2) stored in cartridge.	Open annually. Check powder for signs of caking. Weigh cartridge, renew if weight loss exceeds 10%. Check for signs of corrosion, etc. Check plunger for free movement. Recharge every 5 years.
Dry powder (stored pressure)	B.S.3465	as above	Contain powder (usually sodium bicarbonate with additives) and gas (usually air) under pressure.	Check annually for loss of weight. Check pressure if gauge fitted. Clean nozzle and check for signs of corrosion and damage. Recharge every 5 years.
Carbon dioxide	B.S.3326	as above	Contain liquified carbon dioxide under pressure. Container is sealed and the sealing disc is pierced when operated. Initial weight is stamped on neck.	Check annually for loss of weight. Return to manufacturers when weight loss exceeds 10% of initial weight or in any event after 10 years. Check externally for corrosion or damage.

Not recommended

Methyl bromide C.T.C. and C.B.M. — Although suitable for oil and similar fires their use is not recommended because of the very toxic nature of the chemicals used.

Sand — Suitable for oil and electrical fires, but not recommended, as other types are more effective and are liable to cause less damage.

Periodical inspections — In addition to a thorough annual serviceability check, all extinguishers should be inspected externally not less than once a quarter for signs of damage or corrosion and to check that they have not been discharged accidentally, that nozzles are not obstructed or encrusted and hose (if any) is in good condition, and that extinguishers are in their proper position.

Pressure testing — Where extinguishers are examined regularly and are taken out of service when significant signs of corrosion are noted, periodical pressure testing is not considered to be necessary.

Recharging extinguishers — The recharging date should be indelibly indicated on each extinguisher. A proportion of each type of extinguisher should be discharged each year, during periods of staff instruction, e.g. one half of the foam types and one fifth of water types. Water and foam extinguishers should be thoroughly washed out with clean water before recharging but dry powder type should be kept completely free from water. Only charges appropriate to the type of extinguisher and obtained from the manufacturer should be used.

Appendix 3 continued

Fixed installations

Type	*British Standard Code of Practice*	*Use*	*Remarks*	*Maintenance*
Water Sprinkler	C.P.402.201	General, i.e. paper, wood, textiles	Automatic in operation. Water sprayed over protected area when detector device in sprinkler head operates in response to high ambient temperature caused by outbreak of fire. Operation of equipment can be arranged to initiate fire alarm systems.	At weekly intervals: Examine water and (where fitted) air gauges for correct pressure. Check water levels and air pressure in pressure tanks (where fitted). Test audible alarms by opening test valve. Check main stop valves for free movement and ensure that they are left fully open. At quarterly intervals: Check each water supply individually by closing other supply inlet valves and opening the drain valve. Check that back pressure valves are operating properly. This test should also bring into operation any automatic mechanism in connection with pumps or other water supply apparatus, although these appliances may also be brought into operation by opening the test valves. Examine each sprinkler head for dirt, corrosion or damage and ensure that they are unobstructed.
Carbon dioxide		Particularly suitable for flammable liquids and electrical fires in enclosed spaces	Automatic in operation with emergency manual control. Fire is extinguished by the introduction of an inert gas (carbon dioxide) which replaces the air in the vicinity of the fire and so cuts off the supply of oxygen. Available for total flooding of enclosed space or for local application where screens are provided to retain the gas sufficiently to extinguish fire. Essential for personnel to withdraw during use. Operations of equipment can be arranged to initiate fire alarm system.	Once a year: Remove and weigh carbon dioxide cylinders; if loss exceeds 10% return to manufacturers one at a time for recharging. Check all mechanisms and detectors in accordance with manufacturers' instructions and reset all valves and trips. Once every 5 years: Blow out all distribution pipes with air or carbon dioxide.

Appendix 4

Oil fuel installations

General

1. Basic safety requirements demand complete incombustible separation between main oil storage facilities and any fire risk, also the provision of safeguards to ensure that oil from the main storage tanks cannot flow into the fire risk area due to gravity or syphonic action. Installations should be generally in accordance with British Standard Code of Practice C.P. 3002.

Service tanks

2. Where a service tank is provided in the boiler house or engine room its capacity should be limited to one day's supply or 200 gallons, whichever is the least.

Main storage

3. Storage tanks should be carefully sited so as not to constitute a fire risk to any hospital buildings. They should preferably be sited in the open, well away from buildings and enclosed in catchpits which are capable of retaining the total contents of the tanks.

4. Where it is necessary for the main storage tanks to be within a building they should be located at the lowest possible level and as near as possible to an

outer wall. In no circumstances should they be located above ground floor level. Tank chambers should be entered from the outer air only and should have adequate ventilation direct to the outer air, e.g. by louvres in the access door. There should be imperforate fire resisting construction between the main storage tanks and the remainder of the premises and the chambers should form a catchpit for the total contents of the tanks. Each tank shall have a separate vent to atmosphere having a cross-sectional area at least equal to the filling pipe and an oil level indicator which can be seen from the filling position.

5. Where located below ground floor level a foam inlet should be provided with the inlet located at a level between 15 in. and 30 in. above ground level on the external wall of the premises. The position and type of the inlet should be agreed with the local fire authority. The housing for the inlet coupling should be similar to that recommended for rising mains (see Appendix 8) and should be marked "FIRE BRIGADE—FOAM INLET" in 2 in. letters on the inside of the glass door. Pipe runs should be of $2\frac{1}{2}$ in. or 3 in. galvanised wrought iron and kept as short as possible and be without sharp bends or rises. Elbows should not be used. In the tank chamber the open end should terminate about 6 in. above the level that the oil would reach should the total contents of the tank when full be discharged into the chamber.

Fire valve

6. A fusible link-operated fire valve should be provided at the outlet of the main storage tanks, the fusible links being located above the oil burners or engine and arranged to operate at 155° F.

7. A remote control to the fire valve should be provided, e.g. by a quick-release device located at the entrance to the boiler house or engine room, and a prominent notice provided to draw attention to its use in an emergency.

Preheated oil lines

8. Where electric heating is used, neon type indicating lamps should be provided to indicate when the circuits are energised. The heating load should be carefully chosen to reduce the possibility of serious overheating and a reliable thermostatic control provided.

9. Where valves are so arranged that it is possible to close both ends of a heated oil line, a relief valve with drip pipe and container to retain the discharged oil should be provided.

Instructions

10. Detailed instructions as to the correct operation of the installation should be permanently exhibited in a suitable position.

11. The correct grade of oil for which the installation is designed should be clearly indicated and staff who are responsible for receiving oil supplies should check each delivery to ensure that the correct grade is supplied.

Testing and safety devices

12. Oil fuel installations should be regularly serviced; where the plant is not constantly manned it is important that the safety devices are carefully tested periodically, e.g. at 3 monthly intervals. The following tests should be carried out:

(i) ***Fire valve*** Disconnect the fusible link line and check that the oil cut-off valve operates.

(ii) ***Oil level alarm*** It is usually possible to raise the float or other device by hand and so check that the alarm operates at the high level position.

(iii) ***Oil cut-off*** Shut down burner and check whether oil flow continues.

(iv) ***Flame failure cut-off*** Shut off oil supply and check that burner shuts down and does not restart.

(v) ***Ignition failure cut-off*** Switch off ignition and start up the burner to check that oil supply is cut off within 15 secs.

Appendix 5

Fire precautions in laboratories

Heating

1. Space heating should be by low temperature means only and where electric heaters are used they should be of an enclosed type (see para. 119). Supplementary space heating of a temporary nature should be avoided.

Lighting

2. General lighting fittings should preferably be of an enclosed type and bench or portable lighting fittings should be enclosed sufficiently to protect the lamp against mechanical damage.

Fume cupboards

3. Lighting fittings in fume cupboards and in any other confined locations where there is a risk of a flammable concentration of gases or vapours should be of a flameproof type complying with B.S.229.

4. Adequate mechanical ventilation, direct to the outer air, should be provided in fume cupboards and other areas where flammable gases or vapours are likely to be used. Any electric motors for this purpose which are liable to be exposed to highly flammable gases or vapours should be of a flameproof type complying with B.S.229. Switches or

other sparking sources should be installed outside the cupboard.

Gas installations

5. The use of open flame equipment should be eliminated as far as is practicable in areas where highly flammable liquids or substances are used. Where gas heating is necessary, the precautions set out in paras. 101-103 should be complied with.

6. Wherever practicable gas taps should preferably incorporate a safety device to reduce the risk of inadvertent operation. Flexible connections to gas appliances are undesirable but, where they cannot be avoided, tubing and connections should comply with B.S.669.

Electrical installations

7. Electric wiring should be permanently installed as far as is practicable and an adequate number of socket outlets provided to eliminate the need for improvised arrangements and to minimise requirements for flexible wiring. Socket outlets should not be located over or immediately adjacent to sinks or in other areas where moisture may be present. Where non-standard supply voltages are used, the sockets or connectors used should not be interchangeable with mains connectors and the operating voltage should be clearly and indelibly indicated on or adjacent to each outlet.

Flammable liquids

8. Work involving the use and liberation of highly flammable gases or vapours should be carried out in fume cupboards, where practicable.

9. Flammable liquids should never be used for cleaning benches or large apparatus nor disposed of down drains or sinks (see para. 79).

Unattended apparatus

10. Special precautions are necessary where equipment is left connected to the supply during non-working hours, particularly where such equipment incorporates heating facilities and there is a possibility of over-heating. In these instances a preset thermal cut-out should be provided in addition to the normal thermostatic control. Where it is normal to leave electrical equipment in unattended use it is desirable to install automatic fire detectors (see App. 2 paras. 12-21).

Waste

11. Metal bins with self-closing lids should be provided for flammable waste, separate bins being provided for highly flammable materials. The purpose of each bin should be clearly marked, preferably by distinctive colour marking.

Fire appliances

12. Adequate hand-operated fire appliances are essential. Powder and carbon-dioxide extinguishers are probably the most suitable for laboratories (see Appendix 3).

13. All laboratory personnel should be instructed in the correct use of the extinguishers.

Appendix 6

Fire precautions in radiation hazard areas

1. The following comments are based on the recommendations of a panel set up by the Minister of Health to consider fire hazards with teletherapy units and measures to minimise radiation hazards in the event of fire.

2. In general, rooms which contain radio-active materials are of substantial construction to minimise radiation hazards and this protection will provide an effective barrier against fires originating outside the rooms. Furthermore there is no inherent significant fire risk associated with radio-active sources and if appropriate steps are taken to eliminate the use of flammable materials within the rooms, the risk of fire should be slight.

3. The effect of fire in these areas, however, may present a serious risk to fire fighting personnel in the event of the special precaution against radiation being destroyed, e.g. by causing lead shielding to melt.

The following precautions are recommended:

General

4. Flammable materials should be kept to the minimum practicable and flammable wall and floor finishes should be avoided. Furniture should be of hardwood, metal, or plastic.

5. Electric wiring should be permanently installed as far as is practicable and consist of mineral insulated metal sheathed cable or be enclosed in screwed heavy gauge steel conduit or steel trunking. Wiring which is required to be flexible should be of a heavy duty type having a protecting sheath.

Ventilation plant

6. Means should be readily available to shut-down air conditioning or ventilating plant in the event of a fire outbreak. Automatic shut-down may be justified depending on prevailing conditions.

Automatic fire detection

7. Automatic call points connected to the hospital fire alarm system should be provided.

Doors

8. All doors should be closed during periods when the rooms are not in use, particularly at night.

Fire procedure

9. The local Fire Authorities should be fully informed of the location and risk to firemen of all radio-active sources in the hospital. The method to be adopted in fighting fires at these locations, including first-aid measures, should be agreed between the hospital Physicists and the Chief Fire Officer.

10. Each hospital using radio-active material and equipment should have trained personnel available on a 24 hour basis to advise and guide the chief of the attendant fire brigade in the event of a fire on the premises. During the first half-hour or so, following an outbreak of fire, the above duties may be assumed by a member of the resident staff (for example, radiographer or engineer) pending the arrival of a physicist.

11. Gloves and other protective apparel should be provided at strategic points outside the risk areas, and should be readily accessible in case of emergency, either for the use of the resident staff or firemen. The firemen will not be expected to carry protective apparel as part of their standing equipment. After use, the gloves and other apparel should be washed down with clean water and monitored.

12. The hospital's own fire-fighting rules should include a clause that appropriate radiation-monitors should be provided. Officers in charge of fire-fighting and their operating personnel should not enter a controlled area as defined in the Code of Practice,* unless accompanied by the official who is nominated by the hospital and who is equipped with radiation-monitoring equipment.

* Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use. Published by H.M.S.O.

Appendix 7

Fire precautions in entertainment premises

General

1. Although licensing by the statutory authority may not be applicable to hospital premises which are vested in the Minister, there should be no relaxation of fire and general safety standards because of this. Hospital authorities should voluntarily comply with appropriate safety regulations and should consult with the licensing authority to this end.

The Cinematograph Acts, 1909 and 1952

2. The regulations made under these Acts should be strictly complied with where premises are used for entertainment involving the use of flammable type film, e.g. 35 mm.

Stage lighting and effects

3. Where entertainment is given which involves the use of stage lighting and effects, properly installed switching and dimming facilities together with an adequate number of permanently installed socket outlets should be provided to enable all mains operated electrical equipment that is likely to be used to be connected to the supply with the minimum amount of flexible wiring. Flexible cords should be of a heavy duty type, e.g. sheathed P.V.C. insulated cables complying with B.S.2004. Lighting fittings should be purpose made (not improvised) and be constructed of non-ignitable materials. They should be guarded where they are liable to come into contact with drapes.

4. Scenery, drapes, curtains and other properties should be constructed of fire resisting materials or be rendered and maintained flame-retardant.

5. Unstiffened nylon, terylene and wool and pure silk materials are considered to be flame-retardant without further treatment.

Emergency lighting

6. Sufficient lighting supplied from a maintained lighting system or from two independent supplies, should be provided in all parts of the premises, including exitways, to which audiences have access, to enable persons to move freely. Exit notices should also be illuminated by means of a maintained supply.

7. Lighting in public portions of the premises should not be locally switched; the controls should be so located that they are not readily accessible to the public.

8. The provision of emergency electrical supplies for lighting and other purposes is dealt with in Hospital Technical Memorandum, No. 11.

Flame retardant treatment of stage scenery, decorations, etc.

(Reproduced from Fire Protection Association Booklet No. 14.)

9. A solution based on either of the following formulae is recommended for treating fabrics used for stage scenery and decorations:

1.	Borax	10 ozs.
	Boracic acid	8 ozs.
	Water	1 gallon
2.	Boracic acid	15 ozs.
	Sodium phosphate	10 ozs.
	Water	1 gallon

10. The quantity of solution to be absorbed should be such that after treatment, the dry weight of the material is increased by 10%. In order to achieve this, it is necessary to immerse the material in the solution, and spraying, therefore, is not recommended.

11. These compositions are water soluble and will lose their effectiveness in the event of contact of the material with water. Renewal of the treatment will then be necessary.

12. Whilst a certain degree of resistance to a small source of ignition is provided by the above treatments, the material treated will not become non-combustible, and treatment will not prevent the material being completely consumed once it becomes involved in a fire.

13. Some degree of protection may be provided for timber used for stage scenery by the application of a flame retardant paint. The flame retardant property of a film of paint is directly related to its thickness, and normally two coats are required. The total amount of paint required for effective treatment is usually 0·05 to 0·10 lb of paint per square foot of surface treated.

14. The following formula for flame retardant paint is given in Part 2 of B.S.476:

Sodium silicate	112 lb.
Kaolin (China clay)	150 lb.
Water	100 lb.

15. The sodium silicate shall be of a "neutral" grade in the form of an aqueous syrup in which the ratio of silica to soda is between Na_2O: 3·2 SiO_2 and Na_2O: 3·4 SiO_2 and which has a specific gravity between 1·41 and 1·43.

16. It should be remembered that the most that can be expected of this treatment is only some measure of resistance against actual ignition at the surface which has been treated.

Appendix 8

Rising fire mains

General principles

1. In buildings where any floor is 60 ft. or more above ground level rising fire mains with hydrant outlets should be installed to serve all floors above ground level. Where the topmost floor is not more than 200 ft. above ground level "dry" mains are usually satisfactory. In buildings where any floor is more than 200 ft. above ground level "wet" mains are necessary. Wet rising mains will also be required for hose-reels.

Siting

2. Rising mains should normally be sited (*a*) within a ventilated lobby of a lobby-approach staircase, where this is provided, or (*b*) in a staircase enclosure, or (*c*) in such other position as may be agreed after discussion with the Chief Fire Officer.

Number of risers

3. Rising mains should be provided so that all parts of the building above first floor level, including the roof, can be reached by a hose not exceeding 200 ft. in length, when connected to the nearest available outlet (see para. 7). If this requirement cannot be met with one rising main, additional mains will be required.

Size of risers

4. For "dry" rising mains (not exceeding 200 ft.) an internal diameter of 4 in. is satisfactory. "Wet" rising mains (in excess of 200 ft.) should have an internal diameter of 6 in. For hose-reels a 2 in. riser with 1 in. outlets is usually satisfactory.

Construction of risers

5. Unless otherwise required by the water supply undertaking concerned, the riser should be of galvanised wrought steel piping, heavy quality, red band (B.S. 1387), screwed and socketed. The fittings should be of malleable iron or wrought iron, galvanised and of steam quality. All changes of direction of the run of piping should be made with standard bends, springs or long turn fittings. Elbows should not be used.

6. A suitable automatic air release valve should be fitted above the roof outlet on each dry rising main to allow the air in the pipe to discharge to atmosphere when water is pumped in at the base.

Outlets

7. Outlets should be provided on each riser at each floor level, above first floor, and on the roof so that no point on any storey is more than 200 ft. from an outlet, this distance being measured along a route suitable for a hose. In residential blocks it may be acceptable if outlets are provided on every other floor, above the first floor, and on the roof. In such cases the 200 ft. distance mentioned above should include any distance up or down any stairway. If more than one outlet is necessary on any floor an additional riser, or risers, would normally be installed and so positioned to minimise the length of hose required to reach any part of the floor.

8. The outlets should be of a type approved by the fire authority and should comprise a $2\frac{1}{2}$ in. copper alloy gate pattern valve, complying with B.S.1952, screwed or flanged for attachment to the dry riser

and fitted with a $2\frac{1}{2}$ in. instantaneous female coupling to B.S.336, and a blank cap secured by a suitable length of chain. The hand-wheel of the valve should be marked with OPEN and SHUT directions and open anti-clockwise and shut in a clockwise direction. The whole fitting should be of sound construction and hydraulically tested to a pressure of 300 lb. per sq. in. before being connected to the rising main.

9. Where outlets are required to be recessed into the wall in a duct or alcove, the opening should give not less than 6 in. clearance on both sides and below the valve and not less than 8 in. clearance above the hand-wheel. The depth of the opening should not be greater than is necessary and in no case should the front edge of the female coupling be more than 3 in. behind the face of the wall. The opening should be fitted with a hinged clear-glazed door and the lock of the door should be spring-loaded so that in an emergency the door can be opened from the inside after the glass has been broken. If this is not practicable, each outlet should be kept strapped shut, the strap being secured by a padlock. If a glazed door is provided this should be conspicuously indicated by the words FIRE BRIGADE—DRY MAIN or WET MAIN as appropriate in block letters on the inner face of the glass.

10. Outlets should be installed about 2 ft. 6 in. above floor level.

Inlets for " dry " risers

11. A four inch riser should be fitted with two inlets and a six inch riser with four inlets for fire brigade connections, each inlet consisting of a $2\frac{1}{2}$ in. instantaneous male coupling, a non-return valve, and be protected by a cap secured with a suitable length of chain; the coupling to conform to British Standard 336. A one inch drain valve should be fitted to the riser, normally in the inlet box. If, however, any part of the pipework falls below inlet box level, a similar valve should also be provided at the lowest point of the pipework, together with facilities to conduct water from the valve to a suitable drain, in the form of either fixed piping or an adequate length of flexible tubing fitted with a suitable coupling for connection to the valve. Where an additional drain valve is fitted, a permanent notice should be provided in a position adjacent to the valve, reading DRY RISING MAIN-DRAIN VALVE, and a further permanent notice should also be provided in the inlet box, reading LOW LEVEL DRAIN VALVE IN .... ROOM. The low-level drain valve should be kept strapped and padlocked closed, except when in use.

12. The inlets should be sited:

(i) At a convenient position on the external wall of the building about 3 ft. above the ground.

(ii) Not more than 40 ft. distance from the vertical run of the rising main.

(iii) To be easily accessible from external hydrants.

(iv) To enable a pumping appliance to be brought within sight of the inlet and close enough to allow easy connections. In no instance should it not be possible to bring a pump within 60 ft. of the inlet.

13. Inlets should be housed in a glass-fronted box as follows:

(i) Glazed with wired glass and conspicuously indicated by the words FIRE BRIGADE—DRY MAIN INLET in block letters on the inner face of the glass.

(ii) Fastened only by means of a spring lock which can also be operated from the inside without the aid of a key after the glass has been broken.

(iii) Made large enough for a hose to be connected to the inlets even if the door cannot be opened and the only means of access is by breaking the glass, and not smaller than 22 in. × 15 in. × 12 in.

(iv) The bottom should have a fall of 1 in. in 12 in. towards the front at the base.

Water supply for wet risers

14. Each wet rising main should be fed via booster pumps (see para. 17) from two independent water supplies (to allow for the possible failure of one supply) as follows:

(i) A town's main discharging not less than 350 gallons per minute through float valves into a break tank of not less than 2,500 gallons capacity.

(ii) A storage tank of at least 10,000 gallons capacity.

Alternatively this requirement can be satisfied by the provision of a tank or tanks of 10,000 gallon capacity into which a town's main discharges.

15. Where the alternative arrangement is used, it is preferable to install multiple tanks married by a valved connection at a low level, so that the supply will be available should maintenance work be necessary on any one tank. The suction tank, or tanks, should be automatically supplied at the rate of at least 100 gallons per minute by a connection from a town's main through a ball valve. This connection should be completely independent of any connection from which a sprinkler installation is supplied.

16. Each water storage tank should be provided with a 6 in. diameter inlet pipe carrying four $2\frac{1}{2}$ in. instantaneous male inlets to allow the fire brigade to pump water into the tank. These inlets should be located in a glass fronted box on an external wall in a similar manner to that recommended for dry risers (see para. 13).

17. Each wet rising main should be fed by two automatically operated electrically driven pumps, one of which will act as a stand-by. Each pump should be capable of delivering not less than

200 g.p.m. (i.e. sufficient to serve two lines of hose) at an adequate pressure (see para. 19). The pumps should be so located relative to the break tanks or storage tanks that they are permanently primed, and should be provided with an electricity supply from two alternative sources. Details of maintained supplies from essential electrical circuits are dealt with in Hospital Technical Memorandum No. 11.

18. The pumps should operate automatically on a fall of pressure or flow of water in the riser. Manual starting facilities should also be provided. Stopping should only be possible by manual operation.

19. A pressure of not less than 60 lb. per sq. in. should be maintained at the highest outlet with the branch pipe in operation. If the outlets at lower levels would be subjected to a pressure of more than 75 lb. per sq. in. the outlet valves should be designed to reduce the pressure to approximately this figure when water is being discharged. Provision should also be made for reducing the static pressure at the outlets to approximately 100 lb. per sq. in. to safeguard the hose connected to the outlet when the flow of water is stopped at the branch pipe.

Installations during construction of building

20. The wet rising main should be provided as soon as the building reaches a height of 60 ft., and should be extended progressively as work on the building proceeds, in order to provide fire-fighting facilities during the various stages of construction.

Earthing

21. Dry rising mains should be electrically bonded to a convenient earth point, e.g. that of the electrical installation.

Consultation

22. These observations are offered for guidance. It is important that the Chief Fire Officer be consulted at the design stage in respect of each scheme. The water supply undertaking must also be consulted, particularly with regard to available water supplies, standard pipe joints and pipework.

Appendix 9

Some examples of specific causes of fires in hospitals

1. **Careless disposal of smoking materials**

	Reinstatement cost (where known)
In nurses' lounge.	£8,500
In nurse's bedroom.	£5,500
In medical quarters.	£1,200
In stores.	£1,000
In housemaid's pantry.	£550
In concert hall.	£1,100
Lighted cigarette thrown into waste-paper container.	£6,000

2. **Fish fryers**

Fryer left switched on causing fat to boil away.	£2,000
Overheating due to failure of thermostat.	£700
Fat boiled over and ignited by burner.	£1,000
Overheating—pan not fitted with thermostat.	£500

3. **Radiant heaters and open fires**

Portable electric heater left switched on in close proximity to easychair in staff bedroom.	£200
Portable electric heater covered by curtain in sewing room.	
Gas fire in staff bedroom left on unattended and ignited linoleum.	
Linen airing near gas fire in staff quarters.	£700

4. **Highly flammable liquids**

Full half gal. bottle of ether, which was stored in a cupboard, cracked and vapour from leaking ether was ignited by gas sterilisers—three persons suffered first or second degree burns.	
Bottle containing methyl-ether stored in drug cupboard exploded due to spontaneous combustion.	
Methyl-ether swabs used for cleaning were ignited by Bunsen burner and fire spread to open jar of methyl-ether.	

5. **Oil fuel**

Oil leakage from a fractured main store tank flowed into boiler room and was ignited by burner.	£3,000

6. **X-ray processing unit**

Electrically heated water jacket left unfilled.	£700

7. **Laundries**

Fluff in contact with heated surfaces of calender.	£18,000
Fluff ignited in drying cabinet.	£3,000
Spontaneous combustion of linen after passing through ironing machine.	£1,100
Overheated electric motor in drying cabinet	£1,600

8. **Electric irons**

Iron left switched on in maid's bedroom.	£2,500
Iron left switched on in laundry.	£2,500

9. **Electric boiling ring**

Left switched on in maid's bedroom.	£600

10. **Electric wiring**

Short circuit caused by damaged lead-covered wiring in store.	£1,400
Electric wiring developed fault due to ingress of water into roof void	£1,200

11. **Refrigerators**

Overheating of motor, ignited cork insulation.	£150
Accumulated rubbish behind refrigerator ignited by friction of belt drive.	£100

12. **Open grate**

Live coal falling from unguarded grate in staff bedroom.	£700

13. **Overheated flue**

Conducted heat ignited roof.	£3,000

14. **Therapy wax**

Wax being heat sterilised in an open bucket on a 2 kW electric boiling ring boiled over and ignited.	£6,000

15. **Blowlamps**

Lamp used by painter ignited felt lining of roof.	£650
Lamp used by plumber whilst repairing lead valley caused damage to roof.	

Appendix 10

Numerical statistics of fires in hospitals (1956-1964)

1. Careless disposal of smoking materials.	22%
Fish fryers.	12%
Electrical apparatus (other than heaters).	10%
Gas apparatus.	7%
Chimney fires.	3%
Electric heaters.	3%
Highly flammable liquids.	3%
Radio and television sets.	3%
Flues.	3%
X-ray processing units.	2%
Blowlamps.	2%
Electric wiring.	2%
Open grates	2%
Ignition of fluff, etc., in laundries.	2%
Incinerators.	2%
Slow combustion stoves.	1%
Refrigerators.	1%
Miscellaneous or unknown.	20%

References

British Standards Institution

B.S.138: Portable fire extinguishers of the water type (soda acid).
B.S.229: Flameproof enclosures of electrical apparatus.
B.S.476: Part 2. Flammability test for thin flexible materials.
B.S.336: Couplings, branch pipes, nozzles, strainers and auxiliaries for fire hose.
B.S.669: Flexible tubing and connector ends for appliances burning town gas.
B.S.740: Part 1. Portable fire extinguishers of the foam type (Chemical).
B.S.740: Part 2. Portable fire extinguishers of the foam type (gas pressure).
B.S.750: Underground fire hydrants and dimensions of surface box openings.
B.S.1319: Medical gas cylinders and anaesthetic apparatus.
B.S.1382: Portable fire extinguishers of the water type (gas pressure).
B.S.1387: Steel tubes and tubulars suitable for screwing to B.S.21 pipe threads.
B.S.1689: Galvanised mild steel fire buckets.
B.S.1721: Carbon tetrachloride and chlorobromomethane portable fire extinguishers.
B.S.1901: Stirrup pumps. Piston types.
B.S.1945: Fire-guards for heating appliances.
B.S.1952: Copper alloy gate valves for general purpose.
B.S.2004: P.V.C. insulated cables and flexible cords for electric power and lighting for working voltages up to 250V.
B.S.2599: Flax canvas unlined hose for fire-fighting and fire protection.
B.S.2963: Methods of test for the flammability of fabrics.

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Model Code of principles of construction and licensing conditions for premises for the keeping of Petroleum Spirit under the Petroleum (Consolidation) Act, 1928.
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Fire Offices Committee

Rules for Automatic Fire Alarm Installations.
Rules for Automatic Sprinkler Installations.

Fire Protection Association

Booklet No. 6, Portable Fire Extinguishing Appliances.
Booklet No. 14, Fire Precautions in Small Halls Used for Entertainment Purposes.
Booklet No. 24, Industrial Solvents, Flammable Liquids and Low Melting Point Solids.
Booklet No. 30, Electricity and the Fire Risk in Industrial and Commercial Premises.
Booklet No. 32, Storage of Petroleum Spirit.
Booklet No. 36, Fixed Fire Extinguishing Equipment in Buildings.
Booklet No. 40, Automatic Fire Detection and Alarm Systems.
Booklet No. 1008, Fire Hazard of Fish Frying.
Technical Information Sheet No. 3002, Buildings for the Storage of Flammable Liquids.
Technical Information Sheet No. 5002, Electrical Equipment and Flammable Vapours, Gases and Dusts.

Home Office

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